Amendments to the Claims:

This listing of claims replaces all prior versions, and listings, of claims in this application.

Listing of Claims:

1. (Original) An NQR scanner for detecting the presence of a substance containing quadrupole nuclei within an object comprising:

a pulse generating means to generate pulse sequences that are used to irradiate the object in a pulsed magnetic field at a requisite NQR frequency for the substance to be detected;

a high power RF transmit amplifier for amplifying said pulse sequences to produce sufficient magnetic field strength to irradiate a scan volume within which the object is disposed for detection purposes and cause an NQR transition to a detectable level within the substance if present within the object;

a high Q, tunable coil for producing a reasonably uniform magnetic field over the entire scan volume, connected into a tunable circuit for varying the resonant frequency thereof ;

a power matching unit to ensure optimum power transfer from said transmit amplifier to said coil at substantially every frequency the NQR scanner operates;

an electromagnetic shield to fully enclose the coil allowing an opening to pass the object into the scan volume for detection, said electromagnetic shield being adapted to stop external interference from entering the scan volume and electromagnetic emissions from escaping from the coil and scan volume;

a tuning subsystem to determine if the introduction of the object into the scan volume has altered the resonant frequency of the scanning for the substance, and to re-tune the scanner to the requisite resonant frequency;

a low equivalent series resistance (ESR) switch to switch a large capacitance into and out of the tuneable circuit for changing between low and high resonant frequencies, whilst

maintaining a low equivalent series resistance to maintain a high Q in the circuit at low resonant frequencies;

a receiver system for amplifying a received signal from the coil after a delay from each transmitted pulse of the pulse sequence causing irradiation of the object and treating said received signal to improve the SNR;

processing means to process the treated signal to separate out the phase and amplitude thereof and control the pulse generating means;

an isolator to isolate the coil from the receiver system;

comparator means for comparing the measured phase and amplitude of the received signal with a known range or prescribed threshold; and

detection means to detect whether the measured signal corresponds to an NQR signal emitted by the nuclei of the substance being tested, and if present issue an alarm to notify an operator of the scanner that the substance has been detected.

2. (Original) An NQR scanner as claimed in claim 1, wherein the receiving system comprises:

   (i) amplification means to amplify the received signals;

   (ii) a mixer to mix and enhance the received signals for improving the SNR;

   (iii) an analogue-to-digital converter to digitise the enhanced signals and average the signal after each transmitted pulse until the pulse sequence has finished for subsequent digital processing; and

   (iv) an accumulator or digital signal processor to accumulate the digitised and averaged signals over the pulse sequence.

3. (Original) An NQR scanner as claimed in claim 2, wherein said amplification means comprises a small signal amplifier.

4. (Original) An NQR scanner as claimed in claim 2, wherein said amplification means comprises a cold damped amplifier consisting of a matching system and amplifier for amplifying low frequency received signals, and a high impedance amplifier for amplifying high frequency received signals.

5. (Currently Amended) An NQR scanner as claimed in ~~any one of claims 2 to 4~~ claim 2, wherein said processing means comprises a computer to process the accumulated signals by filtering, performing the fast Fourier transform, and cross-correlation techniques to separate out the phase and amplitude of the accumulated signals.

6. (Currently Amended) An NQR scanner as claimed in ~~any one of the preceding claims~~ claim 1, wherein the coil is a multiple loop coil.

7. (Currently Amended) An NQR scanner as claimed in ~~any one of claims 1 to 5~~ claim 1, wherein the coil is a sheet single turn coil.

8. (Currently Amended) An NQR scanner as claimed in ~~any one of the preceding claims~~ claim 1, wherein the scanner includes an electric field shield circumscribing the inside of the coil within the scan volume to limit and contain the electric field produced by the coil so that it interferes to the smallest possible extent with the object being scanned.

9. (Currently Amended) An NQR scanner as claimed in ~~any one of the preceding claims~~ claim 1, including a temperature probe to measure the temperature, and said processing means calculating the requisite adjustment to the resonant frequency of the pulse sequence in the light of the temperature having regard to the substance being detected and controlling the pulse generating means to generate the pulse sequence at the adjusted resonant frequency.

10. (Currently Amended) An NQR scanner as claimed in ~~any one of the preceding claims~~ claim 1, including a Q switch to reduce the Q factor of the coil circuit to a minimum directly after a pulse of the pulse sequence is transmitted, and then return the Q of the circuit to a high level for sensing and measuring the received signal.

11. (Currently Amended) An NQR scanner as claimed in ~~any one of the preceding claims~~ claim 1, including a conveyor belt controllable to automatically transport an object to be scanned to a position close to the center of the coil, and to automatically stop the object at such position so that it can be scanned.

12. (Currently Amended) An NQR scanner as claimed in ~~any one of the preceding claims~~ claim 1, including a second outer shield to provide extra protection against external interference from entering the scan volume.

13. (Currently Amended) An NQR scanner as claimed in ~~any one of the preceding claims~~ claim 1, wherein said pulse generating means is controlled to generate pulse sequences that combat magnetoacoustic ringing and temperature induced intensity anomaly effects.

14. (Currently Amended) An NQR scanner as claimed in ~~any one of the preceding claims~~ claim 1, including RF curtains to prevent the escape of RF interference and prevent RF noise from entering the scan volume.

15. (Original) An NQR scanner as claimed in claim 14, wherein said RF curtains comprise a rubber backed copper curtain.

16. (Currently Amended) An NQR scanner as claimed in ~~any one of claims 1 to 11~~ claim 1, including doors to prevent the escape of RF interference and prevent RF noise entering the scan volume.

17. (Currently Amended) An NQR scanner as claimed in ~~any one of the preceding claims~~ claim 1, including a tuning probe disposed part way between the coil and the shield for the purposes of tuning the coil to the requisite frequency for detection purposes prior to scanning an object brought into the scan volume of the coil.

18. (Currently Amended) An NQR scanner as claimed in ~~any one of the preceding claims~~ claim 1, including an optical fence system to sense the presence of an object approaching the

scanner for scanning, to control the conveyance of the object to the scan volume for scanning and to control subsequent discharge of the object therefrom after scanning.

19. (Currently Amended) An NQR scanner as claimed in ~~any one of the preceding claims~~ claim 1, including a remote operating pod for informing an operator of the scanner the status of the system without the need for looking at a monitor.

20. (Original) A method for detecting the presence of a substance containing quadrupole nuclei within an object, comprising:

conveying an object to a scan volume ;

determining whether the introduction of the object into the scan volume has altered the resonant frequency for detecting a prescribed substance having quadrupole nuclei within the object;

re-tuning a high Q, tunable coil to the requisite resonant frequency with the object in the scan volume;

controlledly generating a pulse sequence to excite NQR in the substance if present in the object;

amplifying said pulse sequence to produce sufficient magnetic field strength from the tuneable coil to irradiate the scan volume for detection purposes and cause an NQR transition to a detectable level within the substance if present within the object;

power matching to ensure optimum power transfer from the amplified pulse sequence to the tuneable coil at the requisite resonant frequency;

irradiating the entire scan volume reasonably uniformly with a pulsed magnetic field at the requisite resonant frequency created by the application of the amplified pulse sequence to the tunable coil;

shielding the tunable coil and scan volume to stop external interference from entering the scan volume and electromagnetic emissions from escaping from the coil and scan volume;

switching the pulsed magnetic field between high and low resonant frequencies as appropriate for exciting NQR in a substance within the object, maintaining a low equivalent series resistance with the tunable coil during such switching;

amplifying a received signal from the coil after a delay from each transmitted pulse of the pulse sequence causing irradiation of the object and treating said received signal to improve the SNR;

isolating the tunable coil from the amplification of the received signal;

processing the treated signal to separate out the phase and amplitude thereof;

comparing the measured phase and amplitude of the received signal with a known range or prescribed threshold; and

detecting whether the measured signal corresponds to an NQR signal emitted by the nuclei of the substance being tested, and if present issuing an alarm to notify an operator that the substance has been detected.

21. (Original) A method as claimed in claim 20, wherein said treating involves mixing the received signals with a reference and enhancing the mixed signals in quadrature.

22. (Original) A method as claimed in claim 21, including digitising and averaging the enhanced signals after each transmitted pulse until the pulse sequence has finished.

23. (Original) A method as claimed in claim 22, including accumulating or digital processing the digitised and averaged signals over the pulse sequence.

24. (Currently Amended) A method as claimed in ~~any one of claims 20 to 23~~ claim 1, including separately matching and amplifying low and high frequency received signals.

25. (Currently Amended) A method as claimed in claim 23 ~~or 24 as dependent on claim 23~~, including processing the accumulated signals by filtering, performing the fast Fourier transform, and cross-correlation techniques to separate out the phase and amplitude of the accumulated signals.

26. (Currently Amended) A method as claimed in ~~any one of claims 20 to 25~~ claim 20, including electric field shielding the inside of the coil within the scan volume to limit and contain the electric field produced by the coil so that it interferes to the smallest possible extent with the object being scanned.

27. (Currently Amended) A method as claimed in ~~any one of claims 20 to 26~~ claim 20, including measuring the temperature and calculating the requisite adjustment to the resonant frequency of the pulse sequence in the light thereof having regard to the substance being detected, and controlling the generating of the pulse sequences to the adjusted resonant frequency.

28. (Currently Amended) A method as claimed in ~~any one of claims 20 to 27~~ claim 20, including reducing the Q factor of the coil to a minimum directly after a pulse of the pulse sequence is transmitted, and then returning the Q of the circuit to a high level for sensing and measuring the received signal.

29. (Currently Amended) A method as claimed in ~~any one of claims 20 to 28~~ claim 20, including automatically transporting the object to be scanned to a position close to the center of the coil within the scan volume, and to automatically stop the object at such position so that it can be scanned.

30. (Currently Amended) A method as claimed in ~~any one of claims 20 to 29~~ claim 20, including further shielding to provide extra protection against external interference from entering the scan volume.

31. (Currently Amended) A method as claimed in ~~any one of claims 20 to 30~~ claim 20, including controlling the generating of the pulse sequences to combat magnetoacoustic ringing and temperature induced intensity anomaly effects.

32. (Currently Amended) A method as claimed in ~~any one of claims 20 to 31~~ claim 20, including preventing the escape of RF interference and preventing RF noise from entering the scan volume via the openings through which the object passes to and from the scan volume.

33. Canceled.

34. Canceled.